Albuquerque Bernalillo County
Water Utility Authority

COMPLIANCE DIVISION
4201 2ND STREET SW, ALBUQUERQUE, NEW MEXICO 87105

WATER QUALITY LABORATORY
STANDARD OPERATING PROCEDURE

WQL SOP 206
Biochemical Oxygen Demand

CURRENT VERSION # 06

Implementation Date: 10/6/08

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Out of Service By: _____ Date: / /
Reason:

History of Revision This table lists the revision history and effective dates of this procedure.

Revision	Date	Description of Changes
		This method has been revised to incorporate the use of nutrient buffer pillows, the use of commercial polyseed and ready to use glucose-glutamic acid ampules. These changes are necessary to provide more consistency when performing the analysis and to provide better quality control. These changes have been implemented to address deficiencies cited in the A2LA audit.

1.0 SCOPE AND APPLICATION

1.1. The standard operating procedure is used to determine the relative oxygen utilization requirements of wastewaters, effluents, and polluted waters.

1.2. This method is applicable for BOD concentrations ranging from 1 mg/L to 2,000 mg/L

2.0 SUMMARY OF METHOD

2.1. The method consists of filling an airtight bottle of the specified size (300 mL) to overflowing, and incubating it at 20°C ± 1° for 5 days. Dissolved oxygen is measured initially and after incubation, and the BOD is computed from the difference between initial and final DO. Because the initial DO is determined immediately after the dilution is made all oxygen uptake, including that occurring during the first fifteen minutes is included in the BOD measurement. BOD measures the oxygen required for the biodegradation of organic substrates, as well as the amount of oxygen used to oxidize some inorganic compounds such as sulfides and iron II and reduced forms of nitrogen.

2.2. The addition of a nitrification inhibitor prevents microbial decomposition of nitrogenous compounds, yielding BOD attributable solely to the decomposition of carbonaceous substrate (CBOD).

2.3. Seeding: it is necessary to include a population of microorganisms capable of oxidizing the biodegradable organic matter in the sample. Samples that have been chlorinated lack these microorganisms and thus must have them reintroduced in order for the test to work. Seed sources can be domestic wastewater, non-chlorinated effluents or influents, or commercially prepared populations of microorganisms. WQL uses a commercially available seed material to provide a more consistent seed.

3.0 DEFINITION OF TERMS

3.1. QA SOP-007- Reference for general terms related to quality and technical procedures, which applies to all standard operating procedures within WQL.

3.2. BOD: Biochemical Oxygen Demand: the amount of oxygen consumed due to microbial decomposition of organic matter.

3.3. CBOD: Carbonaceous BOD: The amount of oxygen consumed during microbial decomposition of organic matter, excluding nitrogenous organic matter.

3.4. DO: Dissolved Oxygen: Amount of oxygen dissolved in a liquid sample.

4.0 INTERFERENCE

4.1. A number of factors, for example soluble versus particulate organics, settleable and floatable solids, oxidation of reduced iron and sulfur compounds, or lack of mixing may affect the accuracy and precision of BOD measurements. Presently, there is no way to include adjustments or corrections to account for the effect of these factors.

4.2. Oxidation of reduced forms of nitrogen, such as ammonia and organic nitrogen, can be mediated by microorganisms and exert nitrogenous demand. Residual chlorine in the sample can cause interference if not removed.

5.0 SAFETY

5.1. Health Hazards

5.1.1. For specific hazards, consult the MSDS for compounds listed in section 7.0 of this SOP [MSDS on file in WQL Conference Room].

5.1.2. Use, store, and dispose of chemicals in accordance with WQL Chemical Hygiene Plan (CHP-Section 5- Revision December 2005).

5.1.3. The samples and reagents used are of unknown biotoxicity and should only be handled while wearing proper PPE. Direct contact should always be avoided.

5.2. Protective Equipment

5.2.1. Wear appropriate Personal Protective Equipment (PPE) in accordance with WQL CHP (Section 5.1 – Revision December 2005) which includes lab coat, gloves and safety glasses.

5.3. Spills and Contamination

5.3.1. Clean up spills immediately in accordance with WQL CHP (Section 5.11-Revision December 2005).

6.0 APPARATUS AND EQUIPMENT

6.1. All analytical equipment requirements for availability, installation, out-of-service, and record keeping (identification, manufacture, serial #, model #, and date of purchase) will follow WQL Quality Assurance Manual (QAM) procedures (Section 5.5).

6.2. Oxygen electrode Orion Model # 97-08-00

6.3. pH meter Orion Model # SA720

6.4. Magnetic stirrer

6.5. Stir bars (TFE)

6.6. BOD bottles, 300 mL

6.7. Erlenmeyer flask 250 mL

6.8. Volumetric flask 1 Liter

6.9. Five gallon carboys with spigots

6.10. Wash bottle with DI water is needed to rinse the electrode prior to analyses and in between sample analyses.

6.11. Volumetric pipettes various sizes

6.12. Serological pipettes class B, various sizes

6.13. Buret 50 mL

6.14. Aeration pump

6.15. Frits

7.0 REAGENTS AND STANDARDS

7.1. **Chemicals/Reagents** - All chemicals and reagents transport and storage requirements will follow WQL QAM procedures (Section 5.6.4).

7.2. **DI water:** Deionized water

7.3. **BOD Nutrient buffer pillows:** (Hach part number 14863-98)

7.4. **Dilution water:**

7.4.1. Prepare Dilution water by adding 19Liters of deionized water (DI H_2O) to a carboy and leave uncapped overnight to saturate with O_2. Add the entire contents of one nutrient buffer pillow pack. Cap the carboy and shake vigorously for one minute to disperse nutrients and ensure saturation of O_2.

7.5. **Polyseed™** (Purchased from HACH P/N 2918700)

7.5.1. Prepare seed by adding one Polyseed™ capsule to 500mL freshly prepared dilution water. While stirring with a magnetic stirrer aerate gently for one hour. Then allow the bran from the capsule to settle, carefully decant the supernatant into a clean 600 mL beaker making sure that no bran transfers.

NOTE: Recommended dilutions for this seeding material are 15, 20 and 25 mL, brought to 300mL with dilution water. Adjust these amounts as needed to calculate the seed factor as described in 12.4.1.

7.6. **Glucose-Glutamic Acid:** (Glu-Glu) Ampules 300 mg/L- Purchased to use (EZ GGA). (Hach P/N 2544-120)

7.7. **Nitrification Inhibitor:** 2-chloro-6-(trichloromethyl) pyridine: Hach PN 2533-34

7.8. **Standard sodium thiosulfate titrant ($Na_2S_2O_3$):** Aqua Solutions PN 8803-4L

7.9. **Standard Potassium bi-iodate:** Aqua Solutions PN6895-1L

7.10. **Potassium Iodide (granular):** Fox PN P275-2

7.11. **Sulfuric acid (H_2SO_4):** Fox PN S561-3

7.12. **Manganous sulfate:** EM science PN MX0210-5

7.13. **Alkaline iodide azide:** Fox PN 0180-1L

7.14. **Starch indicator 1% solution:** Redbird PN 5-570

7.15. **Sodium sulfite solution:** Dissolve 0.1575 g Na_2SO_3 in 100mL distilled water. This solution is not stable; prepare daily.

8.0 QUALITY ASSURANCE/ QUALITY CONTROL

8.1. **Analyst Training** - Analysts must follow the steps outlined in the DOC Training Program for WQL SOP's. Follow requirements in QA SOP-004.

8.2. **Quality Control Requirements** – Follow requirements in QA SOP-005. The Quality Control Requirements section covers the following topics: 1) Quality Control Limits 2) Quality Control - Instrument Performance 3) Laboratory (Method)

8.2.1. The zero check must be exactly zero in order to pass. The calibration check must be within 0.2 mg/L of the initial DO reading in order to pass. If the zero or calibration checks fail, the oxygen meter must be reset to the correct specifications, and the previous set of 10 samples must be re-measured.

8.2.2. To be valid, at least one sample dilution must meet criteria of a residual DO of at least 1 mg/L and a change in DO of at least 2 mg/L after incubation.

8.2.3. Seed factor- The DO uptake attributable to the seed added to each bottle generally should be between 0.6 and 1.0 mg/L, but the amount of seed added should be adjusted from this range to that required to provide glucose-glutamic acid (GGA) check results of 198mg/L ± 30.5 mg/L.

8.2.4. Glucose- Glutamic acid check must yield a result of 198 mg/L ± 30.5 mg/L.

8.3. **Data Evaluation-** Follow requirements in QA SOP-005. The Data Evaluation section covers the following topics: 1) Internal Audits 2) Control Charts Procedures 3) Performance Audits 4) Method Detection Limit Procedures

9.0 MAINTENANCE

9.1. Standardize the sodium thiosulfate (this should be done on a monthly basis or with a lot change).

9.1.1. Using two Erlenmeyer flasks, add 2 grams of KI and 150mL of DI H_2O and 1 mL of concentrated sulfuric acid, using a class A volumetric pipette add 20mL of potassium bi-iodate and dilute to 200mL using DI H_2O.

9.1.2. Titrate with sodium thiosulfate until you achieve a pale straw yellow color, stop titrating add starch indicator until you achieve a constant blue color. Continue to titrate until a colorless endpoint is achieved. Record the volume of the titrant used in the titrant standardization log.

Calculation

$$\text{Normality of Titrant} = \frac{\text{mL } KH(IO_3)_2 \text{ X } 0.025}{\text{\# mL titrant}}$$

9.2. Daily - Check DO of dilution water

9.2.1. To two 300 mL BOD bottles filled with dilution water, add to each: 1mL manganous sulfate and 1mL alkali-iodine-azide reagent, cap and mix by inverting the bottle.

9.2.2. Let the flock settle ~ 2 minutes, the add 1mL conc. sulfuric acid. Cap and invert the bottle several times until dissolution is complete.

9.2.3. Pour 201mL of the contents of the bottle into a 250 mL flask

9.2.4. Titrate the contents of the flask with standardized sodium thiosulfate until you achieve a pale straw yellow color, stop titrating add starch indicator until you achieve a constant blue color. Continue to titrate until a colorless endpoint is achieved. Record the volume of the titrant used on the BOD logsheet. Discard contents of the beaker..

9.2.5. Calculate mg/L DO of the test bottles. Calculation: DO mg/L = (#mL titrant) X (mg/L DO/mL of titrant). Use the determined average of both bottles for the concentration of the third bottle to be used for the calibration of the DO meter. For titration of 200 mL sample, 1 mL 0.025M $Na_2S_2O_3$ =1 mg DO/L.

Calculation

$$\text{mg/L DO Dilution Water} = \frac{\text{mL } KH(IO_3)_2 \text{X mL of } Na_2S_2O_3 \text{ titrant (Dilution Water)}}{\text{mL of } Na_2S_2O_3 \text{ titrant (Standardization)}}$$

9.3. Adjusting the DO meter.

9.3.1. Place the DO probe in a 300mL BOD bottle filled with dilution water and stir.

9.3.2. Allow the probe to stabilize.

9.3.3. Check the battery by placing the dial on BT CK and verify that the results are ≥ 13.4. If not change the battery.

9.3.4. Check the zero by placing the dial on the Zero setting and verify that it is zero.(Let stabilize for about one minute.) If need be, use the zero calibration control knob to adjust zero.

9.3.5. Check the Dilution water by placing the dial on H2O and verify that the dissolved oxygen reading is within 1mg/L if the last DO H_2O check.

Note: If the DO reading of the dilution water differs by more than than 1mg/L from the last DO H_2O check refer to section 13.2.

10.0 PROCEDURE

10.1. Sample Handling

10.1.1. **Preservation** – No sample preservation for this method.

10.1.2. **Sample Holding Time** – All analysis must be started within 24 hours of sample collection.

10.1.3. **Storage** – All samples must be stored in a refrigerator at or below 4.0°C, or in an iced cooler during transport.

10.1.4. **Sample Preparation** – Bring all samples to room temperature (approximately 20 ± 3°C), and pH between 6.5 and 7.5 prior to analysis. Samples outside this pH range are adjusted to pH 6.5 to 7.5 using a solution of sulfuric acid (H2SO4) or sodium hydroxide (NaOH) of such strength that the quantity of reagent does not dilute the sample by more than 0.5%.Samples that have been chlorinated must be checked and dechlorinated (See Section 10.5) to ensure no residual chlorine remains.

10.2. Sample Analysis Procedure

10.2.1. Prepare dilution water checks (blanks). Blanks are used as a rough check of the quality of the dilution water. Together with each batch of samples, incubate two bottles of unseeded dilution water and another for every 10 samples. Fill two BOD bottles to overflowing with dilution water. Take initial DO reading. Incubate for five days with associated client samples.

10.2.2. Seed samples used for determining seed depletion factor. Add 15, 20 and 25 mL of Polyseed™ seed solution each to a BOD bottle and fill with dilution water. See note section 7.5.1.

10.2.3. Glu-Glu control- To each of two BOD bottles, add about 150mL of dilution water, add 4 mL of seed, snap open an ampule of EZ GGA and add the entire ampule to the BOD bottle. Fill each BOD bottle to overflowing with dilution water. Cap and shake the bottle vigorously.

Note: The manufacturer recommends 4 mL of seed. Adjust the amount of seed added so that the GLU-GLU results are consistently within the required range given in 12.4.1.

10.3. Sample preparation five day BOD

10.3.1. Dilution technique: Dilutions that result in a residual DO of at least 1 mg/L and a DO uptake of at least 2 mg/L after five days incubation produce the most reliable results. Make several dilutions of prepared sample to obtain DO uptake in the range, >1 mg/L left in the bottle after 5 days and a 5 day oxygen reduction of >2 mg/L from the initial DO. Experience with a particular sample will permit use of fewer dilutions. A more rapid analysis, such as COD, may be correlated approximately with BOD and serve as a guide in selecting dilutions. In the absence of prior knowledge, use of the following dilutions: 0.0% to 1.0% for strong industrial wastes, 1% to 5% for raw and settled wastewater, 5% to 25% for biologically treated effluent, and 25% to 100% for polluted river waters. Values refer to the percentage of sample in the total final volume in the BOD bottle, after volume adjustment with dilution water.

10.3.2. **Dilutions:** Dilutions are prepared directly in the BOD bottle. Add a portion of dilution water. Then using a wide tip volumetric pipet, add the desired sample volume to individual BOD bottles and fill to volume with dilution water.

10.3.3. Add 4 mL of Polyseed™to the individual BOD bottles. Adjust this amount as described in the note to Section 10.2.3 as needed. Record the actual amount of seed used.

NOTE: Seeding: it is necessary to include a population of microorganisms capable of oxidizing the biodegradable organic matter in the sample. Samples that have been chlorinated lack these microorganisms and thus must have them reintroduced in order for the test to work. Seed sources can be domestic wastewater, non-chlorinated effluents or influents, or commercially prepared populations of microorganisms. WQL uses a commercially available seed material (Polyseed™)to provide a more consistent seed.

10.3.4. Fill bottles with enough dilution water, seeded if necessary, so that insertion of stopper will displace all air, leaving no air bubbles. Prepare two bottles at each dilution.

Note: For final dilutions containing less than 1% sample, make a primary dilution in a graduated cylinder before making final dilution in the bottle.

10.3.5. Using the DO electrode and DO meter determine the initial DO of all bottles and replace any displaced contents with dilution water to fill the bottles. Stopper tightly, water-seal, cap, and incubate for five days at 20°±1°C. Rinse DO electrode with DI H_2O between determinations to prevent cross contamination of samples.

10.4. Sample Preparation Five Day CBOD (carbonaceous BOD):

10.4.1. CBOD samples are prepared following the same procedure for the 5 day BOD samples except, after the initial DO reading add 3 mg of nitrification inhibitor to each 300 mL bottle using the powder dispenser then cap.

10.5. Dechlorination

Note: For the daily treatment plant samples only TP2.7 is collected from a location after chlorination. Samples from other clients need to be checked for chlorine unless there is process knowledge that indicates that the sample was not chlorinated before collection.

10.5.1. Neutralization of Chlorinated Samples with Sodium Sulfite:
To a 300 mL volume of samples add:

- 3 mL 1:50 H_2SO_4
- 0.3 gram KI salt:

10.5.2. Titrate sample mixture with Na_2SO_3 solution to a starch - Iodine endpoint and record the amount. Discard the titrated sample.

Note: The amount of titrant used is the amount of Na_2SO_3 necessary to de-chlorinate a sample of the same volume. Add the determined amount Na_2SO_3 to a new volume of sample. Do not use the sample containing KI and H2SO4 for the actual test as these reagents are harmful to the microbes and will not yield usable results.

10.6. Determination of initial DO:

10.6.1. Read the initial DO for all control and client samples (see section 10.3.5).

Note: If the sample contains materials that react rapidly with DO, determine initial DO immediately after filling BOD bottle with dilution water. If rapid initial DO uptake is insignificant, the time period between preparing dilution and measuring initial DO is not critical. Use the calibrated membrane electrode to measure initial DO (see Section 9.3 for calibration adjustments to DO meter).

10.7. Incubation:

10.7.1. Incubate at 20°C ± 1°C BOD bottles containing desired dilutions, seed controls, dilution water blanks, and glucose-glutamic acid checks. Check to ensure each bottle has no air bubbles and has been properly stopped, water-sealed and capped with a plastic cap prior to incubation.

10.8. Determination of final DO:

10.8.1. After five days, remove samples from the incubator and determine DO in blanks, checks and sample dilutions using a calibrated membrane electrode (see Section 10.3.5).

10.8.2. Rinse DO electrode with DI H_2O between determinations to prevent cross contamination of samples..

11.0 DATA REPORTING

11.1. **General Reporting:** If more than one sample dilution meets the criteria of a residual DO of at least 1 mg/L and a change in DO of at least 2 mg/L after incubation and there is not evidence of toxicity at higher sample concentration or the existence of an obvious anomaly, average results in the acceptable range.

Note: In these calculations, do not make corrections for DO uptake by the dilution water blank during incubation. This correction is unnecessary if dilution water meets the blank criteria, oxygen depletion occurs less than 0.2 mg/L. If the dilution water does not meet these criteria proper corrections are difficult and results become questionable. The data should be reported as "N" with text indicating that the dilution water showed greater than 0.2 mg/L BOD and a corrective action initiated as described in section 12.3.

11.2. **Specific Reporting:**

11.2.1. Record the test results and all ancillary information, dates, times, analyst name, measurements and calculations in the appropriate BOD books and DO log and Titrant Standardization Log. The heading and footer information shall be filled out in total with no omissions.

11.2.2. The BOD work sheets shall include the name of the analyst for both set-up and take-off and date and time of test, for both days.

11.2.3. If none of the dilutions for a sample has a residual DO of at least 1 mg/L (over depletion) and a DO uptake of at least 2 mg/L (under depletion) after five days incubation, report on the electronic system (SQL-LIMS) the result as an "N". Text the sample, stating whether the sample 'over depleted' or was 'under depleted'. In the BOD book write the result for the sample as a condition, stating whether the sample was 'under depleted' or 'over depleted.' Do not calculate a numerical result.

11.2.4. If any quality control or testing parameters are not within its control ranges, the data or results for those samples affected must be qualified via text on the sample in the electronic system (SQL-LIMS). The following are quality control or testing parameters that need to be qualified if they fail to fall within their respective control ranges: Glucose-glutamic acid check, dilution water check, and incubation temperature.

11.2.5. Enter results into the electronic system, SQL-LIMS.

12.0 CALCULATIONS –

12.1. When Sample is not Seeded:

$$BOD, mg/L = \frac{D1 - D2}{P}$$

When Sample is Seeded:

$$BOD, mg/L = [(D1 - D2) - ((B1 - B2) \times F)] / P$$

Where:
D1 = DO of diluted sample immediately after preparation, mg/L.
D2 = DO of diluted sample after five days incubation at 20°C, mg/L.
P = Decimal volumetric fraction of sample used ie. # mL sample/300 mL.
B1 = DO of seed control before incubation at 20°C, mg/L.
B2 = DO of seed control after incubation at 20°C, mg/L.
F = Volume of seed in diluted sample/ volume of seed in seed control.

Calculation

$$\text{mg/L DO Sample} = \frac{\text{mL } KH(IO_3)_2 \text{ X mL of } Na_2S_2O_3 \text{ titrant (Sample)}}{\text{mL of } Na_2S_2O_3 \text{ titrant (Standardization)}}$$

12.2. **Logsheet Entry** -Fill out the logsheet each day as follows:

12.2.1. Data Entry for Setup: Fill out the header information for the analysis excluding the information for the Read Analysis Date (subscripted with a 5). Record the Standard Reference numbers for the Dilution Water, Glu-Glu, CCVS, and the Polyseed™ and the sample ID for all samples set up. Record the Sample Date, mL of sample per bottle and bottle number for all samples set up. Record the pH and adjusted pH as necessary as well as the mg/L of chlorine measured and amount of Na_2SO_3 added as necessary. Record the DO_0 concentration measured for the sample dilution. Place the logsheet into the logbook when completed for the day.

12.2.2. Data Entry for Read Analysis: Fill out the analysis date and analyst name in the header for the areas with the 5 subscript. Record the DO_5 concentration measured for the sample dilution. Record the results of the calculations for DO_0 - DO_5 and record the Seed Depletion, Dilution Factor, and BOD_5 for each sample bottle. Record the BOD_5 based on the reporting criteria in Section 11.

12.3. **Corrective Actions**- Follow requirements in QA SOP-003 and QA SOP-005. The Corrective Actions section covers the following topics: 1) Out of Control Data Procedures and 2) Corrective Action Logbooks.

12.4. **Data Assessments** – Follow requirements in QA SOP-005. The Data Assessments section covers the following topics: 1) Accuracy and Precision 2) Data Validation Procedures 3) Data Reporting Procedures.

12.4.1. Seed factor- The DO uptake attributable to the seed added to each bottle generally should be between 0.6 and 1.0 mg/L, but the amount of seed added should be adjusted from this range to that required to provide glucose-glutamic acid (GGA) check results of 198mg/L ± 30.5 mg/L.

For example, if 1 mL of seed suspension is required to achieve 198 ± 30.5 mg/L BOD in the glucose-glutamic acid check, then use 1 mL in each BOD bottle receiving the test wastewater.

13.0 TROUBLESHOOTING

13.1. Electrode drift or sluggish response can be a sign of an improperly functioning electrode. Two common problems are a weak battery and an old membrane. Both should be replaced as necessary following guidelines determined by the specific instrument manufacturers.

13.2. If the DO reading of the dilution water is greater than 1mg/L from the last DO H_2O check to determine if the meter may need membrane replacement.

14.0 WASTE DISPOSAL AND POLLUTION PREVENTION

14.1. All waste disposal procedures will follow the Water Quality Laboratory CHP (Section 5.12-Revision December 2005). Disposal procedure is as follows:

14.1.1. Discard all remaining analyzed samples in an acid sink.

14.1.2. All sample labware must be washed with laboratory soap inside and out followed by multiple rinses with distilled or deionized water.

14.2. Pollution Prevention - Eliminate waste at the source and base the quantity of purchased reagents on expected usage during their shelf life.

15.0 REFERENCES

15.1. SM 5210B BOD Standard Methods for the Examination of Water and Wastewater, online edition

15.2. SM 4500O, Dissolved Oxygen - Standard Methods for the Examination of Water and Wastewater, online edition

16.0 FORMS

16.1. BOD Daily Logsheet

BOD LOGSHEET

SAMPLE DATE: _____ ANALYSIS DATE$_D$ _____ TIME: _____ ANALYSIS DATE$_S$ _____

Nutrient Pillows Ref # _____ Expiration Date: _____

Seed Expiration Date:

DO Instrument ID: SA 720/Probe 97-08-00

pH Instrument ID: Orion 611/Probe 81728WWP

SETUP ANALYST INITIALS$_D$ _____ READ ANALYST INITIALS$_S$ _____

Volume $Na_2S_2O_3$ Titrant used in Standardization: _____ Volume $Na_2S_2O_3$ Titrant used for Dilution Water Blank: _____

SAMPLE ID / STD Ref #	User Sample ID	SAMPLE DATE	mL Sample	BOTTLE #	Initial pH	Adjusted pH	mg/L CL_2	mL Na_2S0_3	DO_0	DO_6	$D_0 - DO_6$	SEED Depletion	DILUTION FACTOR	BOD_6 mg/L	X BOD_6
	BLANK		300												
	BLANK		300												
	GLU-GLU		1:50												
	GLU-GLU		1:50												
	SEED														
	SEED														
	SEED														
	TP2.7														
	TP2.7														
	TP2.7C														
	CCVS		300												
	TP2.7C														
	TP2.7C														
	TP2.7C														
	TP2.8A														
	TP2.8A														
	TP2.8AC														
	TP2.8AC														
	TP2.6														
	TP2.6														

SAMPLE ID / STD Ref #	User Sample ID	SAMPLE DATE	mL Sample	BOTTLE #	Initial pH	Adjusted pH	mg/L CL_2	mL Na_2S0_3	DO_0	DO_5	$D_0 - DO_5$	SEED Depletion	DILUTION FACTOR	BOD_5 mg/L	X BOD_5
	TP2.6C														
	CCVS		300												
	TP2.6C														
	TP2.4Y														
	TP2.4YC														
	TP2.4X														
	TP2.4XC														
	TP2.4														
	TP2.4C														
	TP2.3														
	TP2.3C														
	CCVS		300												
	CCVS		300												

Comments and corrections:

I reviewed this data:

My review indicates the data and calculations are correct